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In re Application of Andrew Peter Phelan

Serial No: 10/816,216

Filing Date: April 1, 2004

For: *Optical Arrangement for Assay Reading Device*

Art Unit: 2877

Examiner:

Confirmation No.: 7299

Attorney Docket No. ISA-008.01

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Sir:

Attached hereto is a certified copy of GB Application No. 0312802.2, filed June 4, 2003, a priority document for the above-referenced application. Should there be any questions after reviewing this submission, the Examiner is invited to contact the undersigned at 617-832-1176.

Dated: December 21, 2005
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Respectfully submitted,
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1.	Your reference	MJL/C397.00/I
2.	Patent application number *(The Patent Office will fill in this part)*	0312802.2
		04JUN03 E812398-1 002819 01/7700 0.00-0312802.2
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	Inverness Medical Switzerland GmbH Bundesplatz 10 6300 Zug Switzerland - 4 JUN 2003
	Patents ADP number *(if you know it)*	8397853002
	If the applicant is a corporate body, give the country/state of its incorporation	Switzerland
4.	Title of the invention	Improvements in or Relating to Systems for Optical Detection or Measurement
5.	Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	Keith W Nash & Co 90-92 Regent Street Cambridge CB2 1DP United Kingdom
	Patents ADP number *(if you know it)*	1206001
6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country / Priority application number *(if you know it)* / Date of filing *(day / month / year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application / Date of filing *(day / month / year)*
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11. I/We request the grant of a patent on the basis of this application.

Signature Keith W. Nash & Co Date 04.06.2003

Keith W Nash & Co

12. Name and daytime telephone number of person to contact in the United Kingdom

Dr M J Lipscombe - 01223 355477

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1.	Your reference	MJL/C397.00/I
2.	Patent application number *(if you know it)*	0312802.2
3.	Full name of the or of each applicant	Inverness Medical Switzerland GmbH
4.	Title of the invention	Improvements in or relating to systems for optical detection or measurement
5.	State how the applicant*(s)* derived the right from the inventor*(s)* to be granted a patent	The applicant is the successor in title of Unipath Limited, the employer of the inventor named overleaf
6.	How many, if any, additional Patents Forms 7/77 are attached to this form? *(see note (c))*	1 additional copy
7.		I/We believe that the person*(s)* named over the page *(and on any extra copies of this form)* is/are the inventor*(s)* of the invention which the above patent application relates to Signature Keith W. Nash & Co Date KEITH W NASH & CO 26 /05/2004
8.	Name and daytime telephone number of person to contact in the United Kingdom	Dr Martin Lipscombe 01223 355477

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Enter the full names, addresses and postcodes of the inventors in the boxes and underline the surnames

ANDREW PETER <u>PHELAN</u> Unipath Ltd Priory Business Park Bedford MK44 3UP 7628506001
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C397.00/I

Title: **Improvements in or Relating to Systems for Optical Detection or Measurement**

Field of invention

This invention relates to assay devices for the measurement of analytes. In particular it relates to electronic readers for use with assay test-strips which use optical methods of measurement.

Background of the Invention

Disposable analytical devices suitable for home testing of analytes are now widely commercially available. A lateral flow immunoassay device suitable for this purpose for the measurement of the pregnancy hormone human chorionic gonadotropin (hCG) is sold by Unipath under the brand-name ClearBlue ™ and is disclosed in EP291194.

EP291194 discloses an immunoassay device comprising a porous carrier containing a particulate labelled specific binding reagent for an analyte, which reagent is freely mobile when in the moist state, and an unlabelled specific binding reagent for the same analyte, which reagent is immobilised in a detection zone or test zone downstream from the unlabelled specific binding reagent. Liquid sample suspected of containing analyte is applied to the porous carrier whereupon it interacts with the particulate labelled binding reagent to form an analyte-binding partner complex. The particulate label is coloured and is typically gold or a dyed polymer, for example latex or polyurethane. The complex thereafter migrates into a detection zone whereupon it forms a further complex with the immobilised unlabelled specific binding reagent enabling the extent of analyte present to be observed.

However such commercially available devices as disclosed above require the result to be interpreted by the user. This introduces a degree of subjectivity, which is undesirable.

Electronic readers for use in combination with assay test-strips for determining the concentration and/or amount of analyte in a fluid sample are known. EP653625 discloses such a device which uses an optical method in order to determine the result. An assay test strip such as that disclosed in EP291194 is inserted into a reader such that the strip is aligned with optics present within the reader. Light from a light source, such as a light emitting diode (LED), is shone onto the test strip and either reflected or transmitted light is detected by a photodetector. Typically, the reader will have more than one LED, and a corresponding photodetector is provided for each of the plurality of LEDs.

US5580794 discloses a fully disposable integrated assay reader and lateral flow assay test strip whereby optics present in the reader enable the result to be determined optically using reflectance measurements.

An important consideration in assay reading devices of this type is the requirement that the assay reader and the test strip are carefully aligned. This is because the visible signal formed in the detection zone (and the control zone, if present) is fairly narrow (about 1mm wide), so a small displacement of the detection or control zone relative to the respective photodetector may significantly affect the reading made by the photodetector. In addition, it is generally important that the photodetector is as close as possible to the test strip, since the amount of light which is 'captured' by the photodiode is fairly small, and the signal intensity normally obeys the inverse square law, so that it diminishes rapidly as the separation between the test strip and the photodetector increases. Thus there is a requirement for the user to carefully align the test stick with the assay result reader which, especially for devices intended to be used in the home, can be problematic.

One solution to this problem is provided by US 5580794, wherein the assay strip is provided as an integral component of the result reader, thereby avoiding the need for the user to insert the test strip into the reader. An alternative solution is taught by EP 0833145, which discloses a test strip and assay result reader combination, wherein the assay result reading device can be successfully triggered to make a reading only when

there is a precise three-dimensional fit between the test strip and the reader, thereby ensuring the correct alignment has been obtained.

Summary of the Invention

It is an object of the invention to provide an inexpensive, typically disposable, assay reader either for use with, or in integral combination with, an assay test strip such as disclosed by EP291194.

It is a further object of the invention to provide an assay reader whereby the optics are provided within the reader in a compact arrangement.

It is yet a further object of the invention to provide an assay reader whereby the optics are arranged within the reader so as to provide an optimal or near optimal path length between the light source and photodetector thus ensuring a strong signal.

In a first aspect the invention provides an assay result reading device for reading the result of an assay performed using a test strip, the device comprising: a light source or sources, said light source/s emitting light incident upon at least two, spatially separated zones of the test strip; and a photodetector which detects light emanating from each of the two said zones. A photodetector which is used to detect light emanating from two distinct zones of the test strip, may be referred to as a "shared" photodetector.

In a second aspect the invention provides an assay result reading device for reading the result of an assay performed using a test strip, the device comprising: at least one light source incident upon a zone of the test strip; and at least two photodetectors both of which are able to detect some of the light emanating from the zone of the test strip illuminated by the light source. Such a zone, "read" by two or more photodetectors, may be referred to as a "commonly read zone".

In a third aspect, the invention provides a method of reading the result of an assay performed using a test strip, the method comprising the use of an assay result reading device in accordance with the first and/or second aspects defined above.

An advantage associated with the arrangement defined in relation to the first aspect of the invention is that of simplicity and economy. The manufacturing cost of the device is an especially important consideration if the reader is intended to be disposable: the photodetectors themselves, being relatively expensive components, form a significant part of the overall cost.

A further advantage is that the arrangement can provide greater accuracy and reduce the need for accurate positioning of the test strip relative to the reader. Suppose, for example, a test strip were provided with two separate, but closely spaced, control zones and a photodetector were positioned in the reader so as to be between the two control zones. If the test strip were slightly mis-aligned, laterally, relative to the assay reader device, the signal from one of the control zones would be less intense as the zone in question would be further from the photodetector. However, the other control zone would necessarily be closer to the photodetector by a corresponding amount, and would therefore provide a stronger signal to compensate for the weaker signal from the other zone. Furthermore it has been observed that the amount of bound material present at a particular zone will vary along the length of the zone in the direction of liquid flow. Preferential binding of the analyte takes place at the leading boundary edge and diminishes along the length of the zone in the direction of liquid flow. Thus any mis-alignment may result in a greater error than might have been expected if the analyte were captured in a uniform fashion. US 5968839 discloses an electronic assay reader for use with a test strip, wherein it is attempted to compensate for this non-uniform binding by the provision in the relevant binding zone of a plurality of deposits of immobilised capture reagent, the density of which deposits increases from the leading boundary to the trailing edge of the zone.

Similarly, the arrangement defined in relation to the second aspect of the invention also reduces the requirement for precise relative positioning of the test strip and the assay result

reading device: there is an in-built signal compensation for any misalignment between the test strip and the assay result reader for any zone which is commonly read by the two or more photodetectors, since relative movement of the commonly read zone away from one of the photodetectors will necessarily (within certain limits) involve movement by a corresponding amount towards the other photodetector/s.

The light emanating from the zone or zones, as appropriate, may be light which is reflected from the test strip or, in the case of a test strip which is transparent or translucent (especially when wet e.g. following the application of a liquid sample), light which is transmitted through the test strip. For the purposes of the present specification, light incident upon a particular zone of a test strip from a light source, and reflected by the strip or transmitted therethrough, may be regarded as "emanating" from the strip, although of course the light actually originates from the light source.

The preferred light sources are light emitting diodes (LEDs), and the preferred photodetector is a photodiode.

Reflected light and/or transmitted light may be measured by the photodetector. For the purposes of this invention, reflected light is taken to mean that light from the light source is reflected from the test strip onto the photodetector. In this situation, the detector is typically provided on the same side of the test strip as the light source. Transmitted light refers to light that passes through the test strip and typically the detector is provided on the opposite side of the test strip to the light source. For the purposes of a reflectance measurement, the test strip may be provided with a backing such as a white reflective Mylar[RTM] plastic layer. Thus light from the light source will fall upon the test strip, some will be reflected from its surface and some will penetrate into the test strip and be reflected at any depth up to and including the depth at which the reflective layer is provided. Thus, a reflectance type of measurement may actually involve transmission of light through at least some of the thickness of the test strip. Generally, measurement of reflected light is preferred.

It is especially preferred that the reading device of the second aspect comprises a plurality of light sources, each light source being incident upon a respective zone of the test strip.

In principle, an assay result reading device in accordance with the invention may comprise any number of light sources and any number of photodetectors. For example, one embodiment in accordance with the first aspect of the invention which is expressly envisaged is the use of three light sources, each illuminating a respective zone of a test strip, and a single photodetector which is shared by all three zones. In practice it is difficult to arrange for more than three zones to share a single photodetector, since the photodetector will have trouble in detecting a sufficiently strong signal from those zones which are furthest away.

Preferably an assay result reader will be in accordance with both the first and second aspects of the invention. Desirably the reader will comprise a plurality of light sources and a smaller plurality of photodetectors. In particular, where the reader comprises X light sources for illuminating the test strip, it will comprise X-1 photodetectors. By sharing of the photodetectors between the respective light sources, the number of detectors required might be reduced still further, e.g. using three photodetectors to detect light emanating from an assay test strip that has been illuminated by five light sources.

More specifically, a preferred embodiment of the invention comprises a first, second and third light source, each light source illuminating respective first, second or third zones of a test strip. Conveniently the first light source illuminates a test zone or detection zone; the second light source illuminates a reference zone; and the third light source illuminates a control zone. The test or detection zone is a zone of the test strip in which an optical signal is formed (e.g. accumulation or deposition of a label, such as a particulate coloured binding reagent) in the presence or absence, as appropriate, of the analyte of interest. (By way of explanation some assay formats, such as displacement assays, may lead to the formation of signal in the absence of the analyte of interest). The control zone is a zone of the test strip in which an optical signal is formed irrespective of the presence or absence of the analyte of interest to show that the test has been correctly performed and/or that the

binding reagents are functional. The reference zone is a zone wherein, typically, only "background" signal is formed which can be used, for example, to calibrate the assay result reading device and/or to provide a background signal against which the test signal may be referenced.

This particular preferred embodiment also comprises two photodetectors. The first photodetector is substantially adjacent to or primarily associated with the first light source and is intended to detect light emanating the zone of the test strip illuminated by the respective light source. However the photodetector is so positioned as to be also capable of detecting some of the light emanating from the second zone of the test strip, illuminated by the second light source.

The second photodetector is substantially adjacent to or primarily associated with the third light source and is intended to detect light emanating from the zone of the test strip illuminated by the respective light source. However the photodetector is so positioned as to be also capable of detecting some of the light emanating from the second zone of the test strip, illuminated by the second light source.

Accordingly, this embodiment is in accordance with the first aspect of the invention since it comprises a plurality of light sources and a photodetector which detects light emanating from at least two spatially separated zones of the test strip. In addition, this embodiment described above is in accordance with the second aspect of the invention, since it comprises two photodetectors, both of which are able to detect some of the light emanating from a zone of the test strip (in this instance, two photodetectors are able to detect light emanating from the second zone of the test strip).

It is preferred that, when the assay strip is correctly inserted into a reader device in accordance with the second aspect of the invention, the commonly read zone will be at a position intermediate between the two photodetectors, such that (within certain limits) a lateral movement away from one of the photodetectors will inevitably involve a corresponding lateral movement towards the other photodetectors, so as to allow for the

desired signal compensation effect. Typically, but not essentially, the commonly read zone will be approximately equidistant from the two photodetectors when the test strip is correctly positioned within the reader.

It is also preferred that, where an assay result reading device in accordance with the invention comprises a plurality of light sources, these are advantageously arranged such that a particular zone is illuminated only by a single one of the plurality of light sources. For example, optical baffles may be provided between or around the light sources so as to limit the portion of the test strip illuminated by each light source.

For the avoidance of doubt, it is expressly stated that any of the features of the invention described as "preferred", "desirable", "convenient", "advantageous" or the like may be adopted in an embodiment of the invention in combination with any other feature or features so-described, or may be adopted in isolation, unless the context dictates otherwise.

The invention will now be further described by way of illustrative example and with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an assay result reader in accordance with the preferred features of the first and second aspects of the invention;

Figure 2 is a block diagram illustrating schematically some of the internal components of the reading device embodiment depicted in Figure 1; and

Figures 3-5 are schematic representations of an embodiment incorporating a preferred light source/photodetector arrangement.

Example 1

An embodiment of an assay result reading device in accordance with the first and second aspects of the invention is illustrated in Figure 1.

The reading device is about 12cm long and about 2cm wide and is generally finger or cigar-shaped. However, any convenient shape may be employed, such as a credit card shaped reader. The device comprises a housing 2 formed from a light-impermeable synthetic plastics material (e.g. polycarbonate, ABS, polystyrene, high density polyethylene, or polypropylene or polystyrol containing an appropriate light-blocking pigment, such as carbon). At one end of the reading device is a narrow slot or aperture 4 by which a test strip (not shown) can be inserted into the reader.

On its upper face the reader comprises two oval-shaped apertures. One aperture accommodates the screen of a liquid crystal display 6 which displays information to a user e.g. the results of an assay, in qualitative or quantitative terms. The other aperture accommodates an eject mechanism actuator 8 (in the form of a despressible button), which when actuated, forcibly ejects an inserted assay device from the assay reading device.

The test strip for use with the reading device is a generally conventional lateral flow test stick e.g. of the sort disclosed in US 6,156,271, US 5,504,013, EP 728309, or EP 782707. The test strip and a surface or surfaces of the slot in the reader, into which the test strip is inserted, are so shaped and dimensioned that the test strip can only be successfully inserted into the reader in the appropriate orientation.

When a test strip is correctly inserted into the reader, a switch is closed which activates the reader from a "dormant" mode, which is the normal state adopted by the reader, thereby reducing energy consumption.

Enclosed within the housing of the reader (and therefore not visible in Figure 1) are a number of further components, illustrated schematically in Figure 2.

Referring to Figure 2, the reader comprises three LEDs 10a, b, and c. When a test strip is inserted into the reader, each LED10 is aligned with a respective zone of the test strip. LED 10a is aligned with the test zone, LED 10b is aligned with the reference zone and

LED 10c is aligned with the control zone. Two photodiodes 12 detect light reflected from the various zones and generate a current, the magnitude of which is proportional to the amount of light incident upon the photodiodes 12. The current is converted into a voltage, buffered by buffer 14 and fed into an analogue to digital converter (ADC, 16). The resulting digital signal is read by microcontroller 18.

One photodiode detects light reflected from the test zone and some of the light reflected from the reference zone. The other photodiode 12 detects some of the light reflected from the reference zone and the light reflected from the control zone. The microcontroller 18 switches on the LEDs 10 one at a time, so that only one of the three zones is illuminated at any given time - in this way the signals generated by light reflected from the respective zones can be discriminated on a temporal basis.

Figure 2 further shows, schematically, the switch 20 which is closed by insertion of an assay device into the reader, and which activates the microcontroller 18. Although not shown in Figure 2, the device further comprises a power source (typically a button cell), and an LCD device responsive to output from the microcontroller 18.

In use, a dry test strip (i.e. prior to contacting the sample) is inserted into the reader, this closes the switch 20 activating the reader device, which then performs an initial calibration. The intensity of light output from different LEDs 10 is rarely identical. Similarly, the photodetectors 12 are unlikely to have identical sensitivities. Since such variation could affect the assay reading an initial calibration is effected, in which the microcontroller adjusts the length of time that each of the three LEDs is illuminated, so that the measured signal from each of the three zones (test, reference and control) is approximately equal and at a suitable operating position in a linear region of the response profile of the system (such that a change in intensity of light reflected from the various zones

each zone whilst the test strip is dry - subsequent measurements ("test values") are normalised by reference to the calibration value for the respective zones (i.e. normalised value = test value/calibration value).

To conduct an assay, a sample receiving portion of the test strip is contacted with the liquid sample. In this case of a urine sample for instance, the sample receiving portion may be held in a urine stream, or a urine sample collected in a receptacle and the sample receiving portion briefly (about 5-10 seconds) immersed in the sample. Sampling may be performed whilst the test strip is inserted in the reader or, less preferably, the strip can be briefly removed from the reader for sampling and then reintroduced into the reader.

Measurements of reflected light intensity from one or more (preferably all three) of the zones are then commenced, typically after a specific timed interval following insertion of the test strip into the reader. Desirably the measurements are taken at regular intervals (e.g. at between 1-10 second intervals, preferably at between 1-5 second intervals). The measurements are made as a sequence of many readings over short (10 milliseconds or less) periods of time, interleaved zone by zone, thereby minimising any effects due to variation of ambient light intensity which may penetrate into the interior of the reader housing.

Example 2

This example described in greater detail the features of the preferred arrangement of LEDs and photodiodes outlined in Example 1.

Figure 3 is a schematic representation of the layout of the 3 LED/2 Photodiode optical system described in Example 1. Figure 4 is a schematic representation of a side elevation of one LED/Photodiode, and illustrating their position relative to a nitrocellulose test strip. Figure 5 is a schematic plan view of the LED/Photodiode arrangement, again illustrating their position relative to a test strip.

Referring to Figure 3, an optics block component for accommodation within an assay result reading device in accordance with the invention comprises three LEDs (LED 1, 2 and 3) and two photodetectors (PD1 and PD2). Light from LED 1 illuminates a test zone of a test strip (not shown) inserted into the reader. Light reflected from the test zone is detected by PD1. Light from LED3 illuminates a control zone of the test strip and light reflected therefrom is detected by PD2. Light from LED2 illuminates a reference zone of the test strip.

Each LED is optically isolated by light-impermeable baffles 14, which ensure that each LED is capable of illuminating only its respective zone of the test strip. However the surfaces of the baffles facing LED2 are angled so as to allow LED2 to illuminate a slightly wider portion of the test strip than LED1 or 3, and this in turn allows light reflected from the reference zone to be detected by both PD1 and PD2.

The relative positioning of the test strip, LEDs and photodiodes may be better understood by reference to Figures 4 and 5.

Referring to Figure 4, a test strip 20 is inserted into the reading device above the plane of the LEDs and photodiodes. The test strip 20 is of laminate construction comprising an uppermost backing layer 22 of reflective opaque white Mylar^{RTM}, a synthetic plastics material, and a lowermost front layer 24 of clear Mylar^{RTM} . Sandwiched between the Mylar^{RTM} layers 22, 24 is a layer of porous material 26 (typically nitrocellulose). The purpose of the Mylar^{RTM} layers is to protect the delicate nitrocellulose and provide mechanical strength and rigidity. In addition, the opaque backing layer 22 is relatively highly reflective, and this serves to improve contrast: relatively little light is absorbed by the layers 24, 26 and much of the light incident upon the various zones would therefore tend to pass straight through the test strip, but the reflective Mylar^{RTM} backing layer 22 ensures that this light is reflected. In addition, since the particulate label accumulating in the nitrocellulose layer 26 absorbs only a portion of the light as it passes through in a generally upwards direction, the label has in effect a second chance to absorb light as it passes back through the test strip 20 in a generally downwards direction, having been

reflected by the opaque Mylar^{RTM} backing layer 22. This significantly improves the signal: noise ratio.

As can be seen from Figure 4 and 5, the photodiodes PD1 and PD2 are aligned with their respective LEDs, LED1 and 3, but are offset, in that the LEDs lie towards one side of the test strip whilst the photodiodes lie towards the other side. Having the photodiodes offset in this way avoids, or at least reduces, the amount of specular reflection from the clear Mylar^{RTM} layer 24 detected by the photodiodes (i.e. light which is reflected directly from the initial Mylar^{RTM} layer 24 without ever penetrating into the nitocellulose layer – detection of such reflections would decrease the signal: noise ratio).

Referring to Figure 4 the relationship between signal intensity (I) and the angle (θ) of the reflected light relative to the photodiode is $I \propto \cos\theta^4$.

Furthermore, the relationship between signal intensity (I) and the distance (x) of the photodiode from the reflecting object is $I \propto {}^1/x^2$ (i.e. the inverse square law).

It is apparent that, in view of the inverse square law, it would generally be preferred to position the photodiodes as close as possible to the test strip (i.e. decrease x), so as to increase the signal intensity I. However, merely decreasing the vertical separation y between the photodiode and the test strip would increase angle θ, decreasing the value of $\cos\theta$ and therefore tend to reduce the signal intensity.

An alternative approach to improve signal intensity would be to re-position the photodiode nearer the centre of the system (indicated by the dotted lines in Figure 4) which would simultaneously decrease X and θ. However, this is found to be undesirable as it increases the likelihood of detecting specular reflections. Accordingly an aligned but offset position for the photodiodes provides an optimal compromise of all these considerations.

It will be noted from Figure 5 that photodiode 1 is aligned with the test zone and photodiode 2 is aligned with the control zone. This alignment ensures that any variation of

the relative positioning of the test strip and assay reader has minimal effect on the angle θ. Whilst PD1 and PD2 are not aligned with the reference zone, and are therefore subject to a relatively large (and therefore undesirable) angle of θ, this problem is not significant because (i) the use of two detectors to read the reference zone allows for compensation of any positional variation, since relative movement of the test strip so as to increase θ for one photodetector will decrease θ for the other photodetector; and (ii) the reference zone is used to give a background reading for calibration purposes - the photodiodes are not required to measure the signal intensity from a narrow line (as with the test or control zones), and so the measurement of the reference zone signal is inherently less sensitive to variation from mis-positioning.

CLAIMS

1. An assay result reading device for reading the result of an assay performed using a test strip, the device comprising: a light source or sources, said light source/s emitting light incident upon at least two, spatially separated zones of the test strip; and a photodetector which detects light emanating from each of the two said zones.

2. An assay result reading device for reading the result of an assay performed using a test strip, the device comprising: at least one light source incident upon a zone of the test strip; and at least two photodetectors both of which are able to detect some of the light emanating from the zone of the test strip illuminated by the light source.

3. A reading device in accordance with claim 1 and in accordance with claim 2.

4. A reading device in accordance with any one of the preceding claims, comprising a plurality of light sources.

5. A reading device in accordance with any one of the preceding claims, wherein the light source or sources comprises LEDs.

6. A reading device in accordance with any one of the preceding claims, wherein the photodetector is a photodiode.

7. A reading device in accordance with claim 1 or any claim dependent thereon, wherein the photodetector is positioned between the spatially separated zones.

8. A reading device in accordance with claim 2 or any claim dependent thereon, wherein the zone is positioned between the two photodetectors.

9. A method of reading the result of an assay performed using a test strip, the method comprising use of an assay result reading device in accordance with any one of the preceding claims.

10. An assay result reading device substantially as hereinbefore described and with reference to the accompanying drawings.

ABSTRACT

Title: Improvements in or Relating to Systems for Optical Detection or Measurement

Disclosed, in one aspect, is an assay result reading device for reading the result of an assay performed using a test strip, the device comprising: a light source or sources, said light source/s emitting light incident upon at least two, spatially separated zones of the test strip; and a photodetector which detects light emanating from each of the two said zones; in a further aspect is disclosed an assay result reading device for reading the result of an assay performed using a test strip, the device comprising: at least one light source incident upon a zone of the test strip; and at least two photodetectors both of which are able to detect some of the light emanating from the zone of the test strip illuminated by the light source.

Fig 1

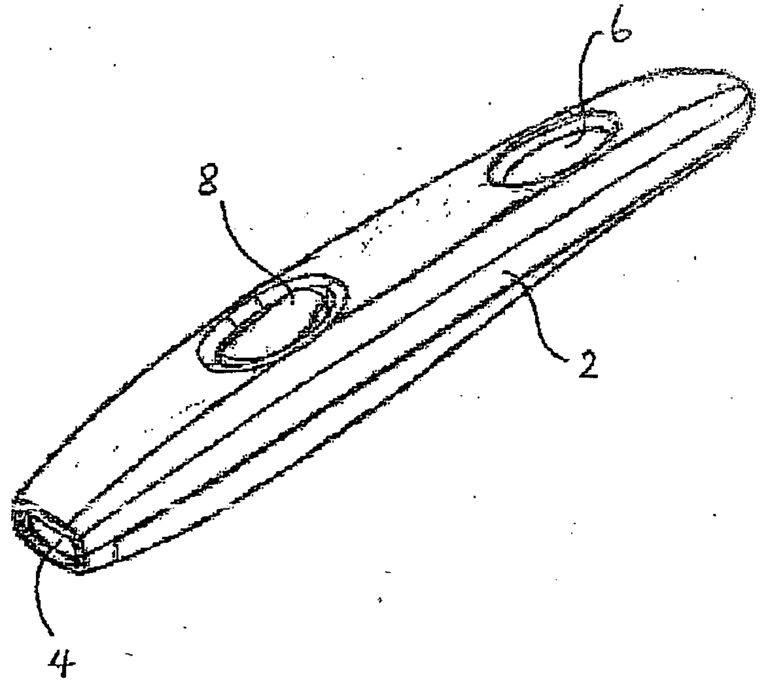

Fig 2

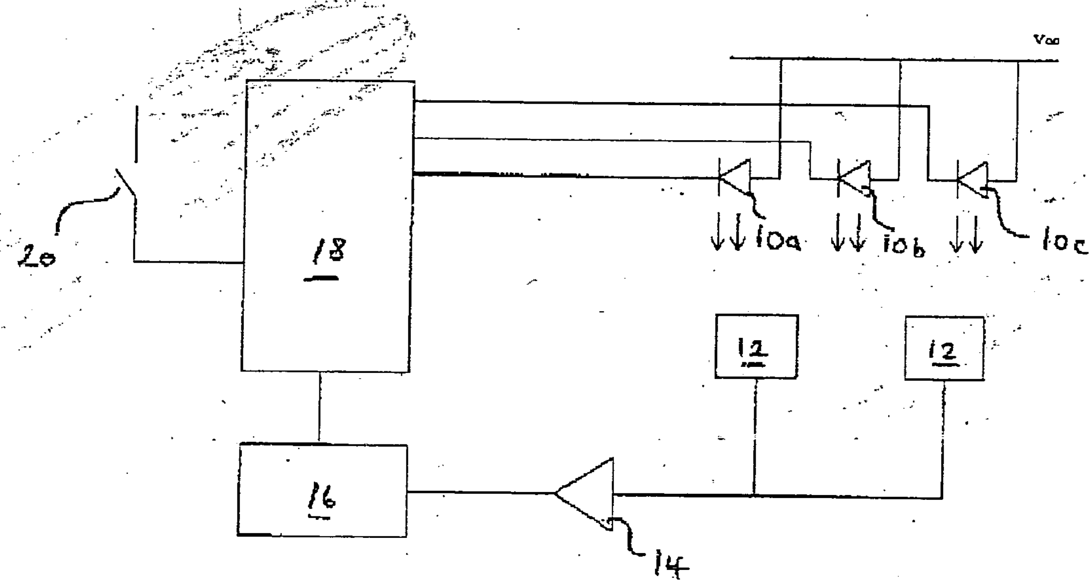

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Fig 3

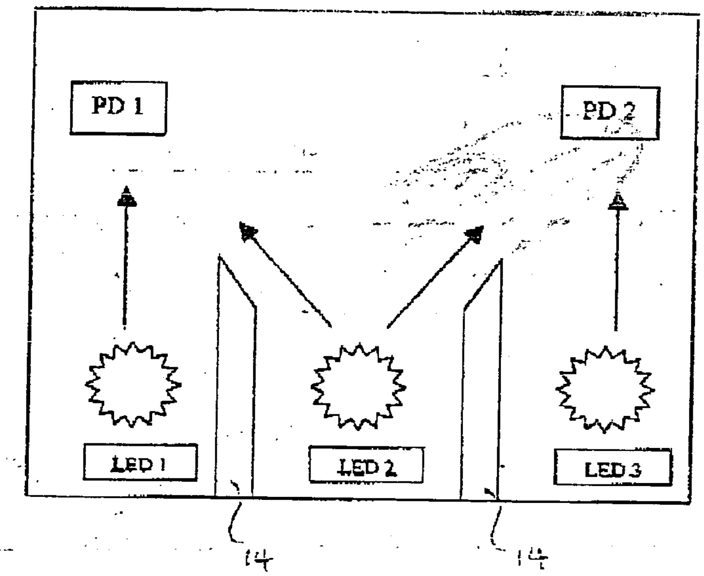

Fig. 4

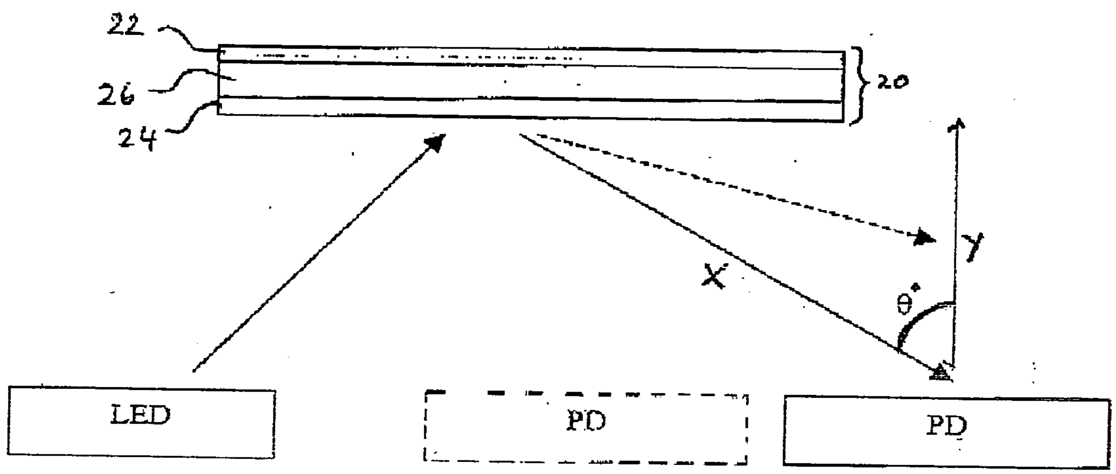

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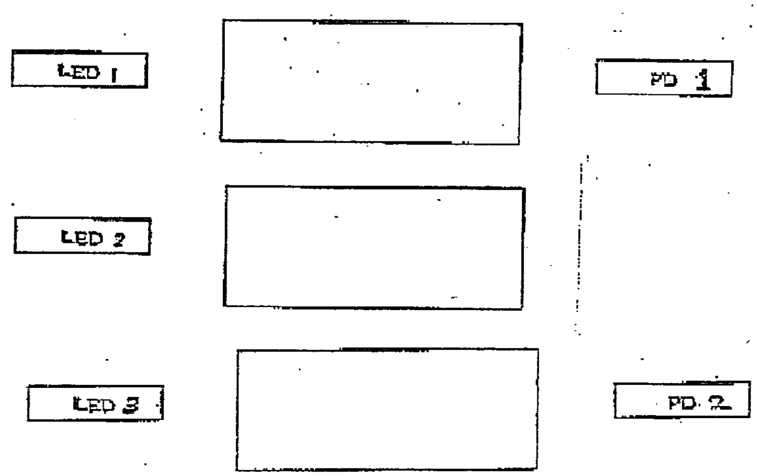
Fig. 5



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